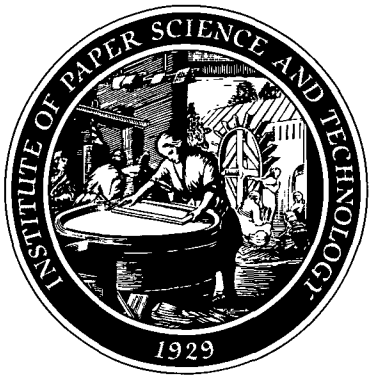

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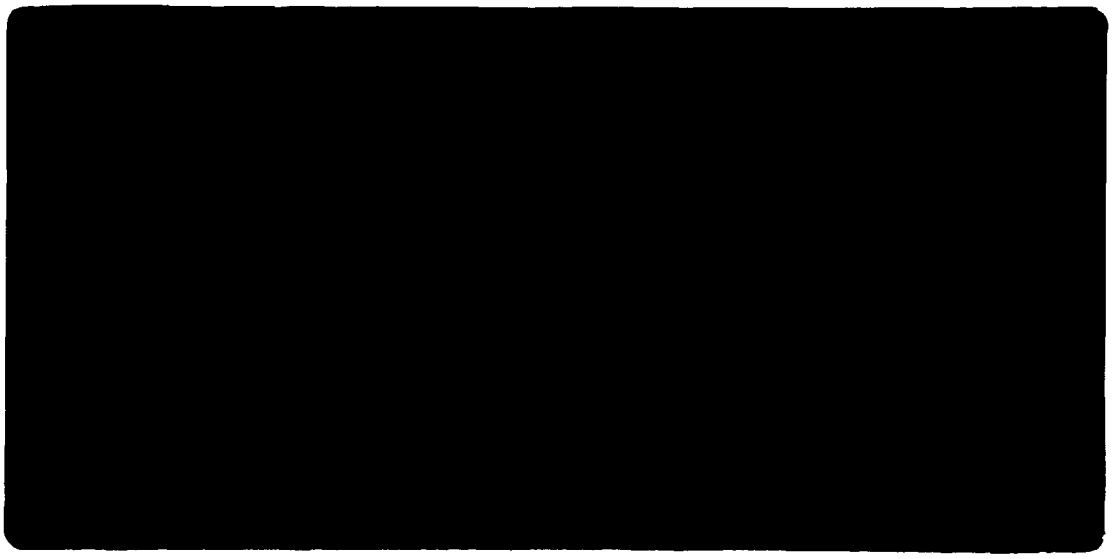

NUMBER 447

FUTURE NEEDS IN PUMPING AND HYDRAULIC SYSTEMS FOR THE PULP AND PAPER INDUSTRIES

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JULY 1992

Future Needs in Pumping and Hydraulic Systems for the Pulp and Paper Industries

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Based on a paper presented at the
Hydraulic Institute Annual Meeting
May 18, 1992
Washington, D.C.

Future Needs in Pumping and Hydraulic Systems for the Pulp and Paper Industries

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ABSTRACT

The pulp and paper industries are changing steadily in response to a variety of driving forces. Environmental pressures, changing domestic and global markets, and technological advances all lead to new demands and new challenges in pulping and papermaking. Many of these changes put new demands on pumps, seals, and other aspects of hydraulic systems. Manufacturers and users of hydraulic systems need to be aware of the future needs of the pulp and paper industry in order to meet the upcoming challenges.

We briefly review several new developments in the pulp and paper industry, and discuss ramifications and challenges for the associated pumping systems. Much of the information and projections here are based upon conversations with those in the pulp and paper industry and pulp and paper specialists in the hydraulics industry. The list of topics covered is far from complete, but represents a sampling of significant areas.

INTRODUCTION

While fluid transport is essential to almost any manufacturing industry, it is at the heart of the pulp and paper industries. Nearly every papermaking process relies heavily on pumping: pulping, bleaching, refining, and stock preparation involve large pumps and complex multiphase flows. In the chemical recovery system of the kraft pulp mill, various pumps must deal with high-temperature caustic fluids, with corrosive solid suspensions, with troublesome foams and intermittent flows, and with the challenges of a large and temperamental boiler. On the paper machine itself, pumps are vital for the high-volume headbox flows of fiber suspension, and directly affect the quality of the paper sheet. Pumps are also essential for the vital white water circulation loops, the showers and sprays for felts and wires, the lubrication systems of high-velocity rolls, the precise metering of chemicals and dyes, the delivery of high-solids coating slurries, and for many other processes. Waste handling offers a variety of complex challenges for hydraulic systems, sludge flows being one of the most interesting. Recycling processes also involve complex flows in which pumping is crucial.

many applications, not only to reduce water consumption but also to prevent pollution from leaks.

On the positive side, several sectors of the pulp and paper industry have made excellent progress in this area. The industry has made substantial advances in the areas of chemical recovery, power generation, pulping and bleaching. Boiler condensate pumps and pumps for black and green liquors are embracing mechanical seals to prevent dilution and water use. Split seal technology has become relatively popular because it's easy to install. Cartridge seals are also finding increased acceptance.

3. Higher Consistency Pulp Suspension Flows

In the future, fiber slurries may be pumped at higher consistencies than is currently done. While environmental pressure for less water consumption is a factor, more important is the need for effective use of high-density (high-consistency) storage tanks which allow paper production to continue during pulp mill downtime. The efficiency of high-consistency pulp storage tanks is limited by the consistency at which pulp can be pumped. Current upper limits of 15-18% consistency may move to 20% or higher. Pumping technology must advance to solve the problems associated with these demanding flows. Screw pumps are becoming more widely used for high-consistency (ca. 12-20%) flows, and several companies have recently produced improved medium-consistency pumps (ca. 8-12%). Most mills still insist on packings, though mechanical seals and dynamic seals are being offered.

No other non-Newtonian fluid is pumped in larger volumes than fiber suspensions, yet the flow behavior of fiber suspensions remains one of the most complex and least understood industrial flows. Rheological properties become increasing challenging and complex as concentration is increased. Problems include abrasion, plugging of lines, and many complexities due to high-gas content in the pulp.

In the past decade, significant gains have been made in pumps for medium-consistency pulp slurries, but feedback from the industry suggests that even greater gains are needed. It also appears that a fundamental understanding of medium and high-consistency flows does not yet exist to fully guide equipment development.

Higher consistencies in paper formation may also become a trend, though it may be a decade away. Current paper machines form paper from slurries often near 0.5% or less in consistency. Research efforts are underway to find improved ways to make satisfactory paper at higher consistencies, say up to 3%, which could drastically reduce water consumption. The interaction of pumps and headboxes in the forming process will be important in these processes.

4. Recycling

The biggest trend in papermaking is the massive move toward using secondary fiber sources. While the increase in recycling has been largely voluntary, much of the motivation has come from the threat of legislative

action rather than economic incentives. As a result, recycling technology is immature relative to its level of application, and rapid mutations are expected in the future. This trend is not going to change: secondary fibers will grow in importance worldwide, outstripping high-quality supplies and forcing many rapid changes in technology. There are many implications for hydraulic systems, two of which are discussed below.

a) New flow streams

Slurries of recycled fibers can have significantly different rheological properties than slurries of virgin fibers, making proper design of pumping systems difficult until more experience and research data are available. Further research efforts are essential to better understand the impact of recycling on flow systems.

Furthermore, high demand will continue to outstrip the supply of high-quality secondary fibers, forcing use of highly contaminated materials. These contaminants may pose severe challenges to current pumping systems. Robust, durable pumps are needed to handle the innumerable oddities that may enter flow streams originating from post-consumer waste.

Ink removal, or deinking, is a rapidly evolving area with many new technologies under development, each placing new demands on flow systems. For example, there may be opportunities for improved handling of deinking froth and sludge.

b) New scales of production

Legislative action and consumer demand have created significant pressures to increase the content of secondary fibers in paper. Mills far removed from population centers are suddenly at a disadvantage in terms of obtaining secondary fibers. A new concept in papermaking is the urban "minimill," a small mill located near the "urban forest" of paper waste where secondary fibers can be acquired inexpensively. Such mills would be much smaller than today's mills and may redefine current thinking about economies of scale. For the hydraulics industry, minimills may offer an excellent niche for innovative manufacturers to meet the specialized demands of small-scale urban mills. Extremely tight restrictions on water use and effluents are likely. Handling slushing, deinking, and sludge flows with small equipment may limit the effectiveness of current technologies and open the doors for others.

5. Alkaline Papermaking

In the manufacture of wood-free sheets, papermaking technology will continue to shift from making acidic paper to alkaline paper. This change is being driven by the demand for acid-free paper and by the economic advantage of using inexpensive calcium carbonate filler in alkaline paper to replace some of the fiber. Filler levels in alkaline paper may range from 10 to 25%, or roughly twice the filler content used in acidic papermaking practice. The new pH range, the new choice of wet-end chemicals, and the increased

CONCLUSION

Future technologies and current needs in pulp and papermaking offer a variety of challenges for the manufacturers of pumps, seals, and related products. Environmental pressures, new and more competitive markets, and advancing technology are among the driving forces for change. The challenge for the hydraulics industry goes far beyond simply developing the appropriate technology; training and education of pulp and paper personnel is often needed to make them aware of solutions and to help them see the need for change. Applying appropriate technology in mills to solve or prevent environmental problems (real or perceived) before they become a crisis is a vital task that may require patience and prodding. Anticipating and preparing for future technologies, markets, and process needs will require aggressive and farsighted action, but innovative companies that take on these risks may be well rewarded.

ACKNOWLEDGMENTS

Many people supplied helpful information for this survey of pumping issues. Special thanks for detailed information goes to Elton Krogel and Tim Suprise of Durametallic Corporation; Rick Steber of Goulds Pumps; Mike Stevens of Ahlstrom Pumps; Roger W. Monternbeault of Peerless Pump; Henry L. Laskey, Pulp and Paper Consultant; Veli Lapinoja of Georgia Pacific Corp.; Samuel Suh of Champion International Corp.; Brian Greenwood of Kamyr, Inc.; and Dick Ellis and Tom McDonough of the Institute of Paper Science and Technology.

Thanks also to the following companies: Albin Pump; Chesterton Pumps and Seals; John Crane, Inc.; Power Packing Company; Roper Pump Company; Georgia Pacific Corporation; Kimberly-Clark Corporation; IMO-Warren Pumps; and Beloit Corporation.